

CLAIMS

We claim:

22. A method for determining the optimal tuning parameters in a linear controller, wherein

- 1) said controller receives an n -dimensional process variable signal $y(k)$ from a process and an n -dimensional set-point signal $r(k)$, calculates an m -dimensional controller output $u(k)$ according to a linear control equation, and sends said $u(k)$ to said process, where k is the integer discrete time variable and n and m are positive integers;
- 2) said tuning parameters are the adjustable numbers in the coefficients in said linear control equation that are to be determined; and
- 3) said method finds the optimal values for said tuning parameters by minimizing the maximum of absolute values of all poles of the discrete-time closed-loop transfer function from said set-point $r(k)$ to said process variable $y(k)$.

23. A method as in Claim 22, wherein said minimization of the maximum of absolute values of all poles of said discrete-time closed-loop transfer function is subject to user-specified constraints placed on one or more of said tuning parameters.

24. A method as in Claim 22, wherein said controller output $u(k) = u(k-1) + K_1 * r(k) * T + K_1 * a(k,1) + K_2 * a(k,2) + \dots + K_p * a(k,p)$, wherein k is the discrete time variable, $*$ is the multiplication operator, T is the sampling period, p is a positive integer, the m by n matrices K_1, K_2, \dots , and K_p are tuning parameters, $a(k,1) = [-y(k)] * T$, and $a(k, p) = [a(k,p-1) - a(k-1,p-1)] / T$ for $p > \text{or} = 2$.

25. A method as in Claim 23, wherein said controller output $u(k) = u(k-1) + K_1 * r(k) * T + K_1 * a(k,1) + K_2 * a(k,2) + \dots + K_p * a(k,p)$, wherein k is the discrete time variable, $*$ is the multiplication operator, T is the sampling period, p is a positive integer, the m by n matrices K_1, K_2, \dots , and K_p are tuning parameters, $a(k,1) = [-y(k)] * T$, and $a(k, p) = [a(k,p-1) - a(k-1,p-1)] / T$ for $p > \text{or} = 2$.

26. A method as in Claim 22, wherein said linear controller is a PID (proportional-integral- derivative) controller.

27. A method as in Claim 23, wherein said linear controller is a PID controller.

28. A linear controller as in Claim 22 with its tuning parameters determined therein.

29. A linear controller as in Claim 23 with its tuning parameters determined therein.

30. A linear controller as in Claim 24 with its tuning parameters determined therein.
31. A linear controller as in Claim 25 with its tuning parameters determined therein.
32. A PID controller as in Claim 26 with its tuning parameters determined therein.
33. A PID controller as in Claim 27 with its tuning parameters determined therein.